

Technical and Operational

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37, 39, 40, 41, 43, 44, 51, 62, 63, 65, 72, 73

An Immunization Registry Provider Feedback Module—The Missing Link in Registries: An Arkansas Case Example

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Key Words: Immunization Registry. Feedback. Arkansas Registry. Provider. Data Quality.

Background: Immunization registries to work efficiently must provide information to those users that submit data specific to the quality of their submittal and the timeliness of this information. Similarly, providers should be regularly informed of the growth of the system, effect on state immunization rates, and number of providers submitting data, etc. This creates a closed loop information system whose objective is to maintain a strong relationship with area providers. Immunization registries to date, have not provided solutions for this type of "user feedback".

The development of the Arkansas immunization registry system, recognized this need and has designed and implemented an electronic Immunization Registry Feedback Module, that utilizes Fax-back and Internet-based technology.

Objectives: To describe effective methods for incorporating the electronic feedback module to provide administrative and end user feedback in the form of reports and statistics. The purpose of which is for improving registry data quality and increasing immunization levels consistent with CDC's AFIX model and the requirement to communicate with a registry provider population.

Methods: The presentation will be based on the Arkansas Record Feedback Module (ARFM) specifically developed for the state by Scientific Technologies Corporation. The system was based on the type of provider submitting data to the central registry, their access method, and the frequency of feedback required. The focus was to implement a seamless electronic notification process. The ARFM provides the ability to quickly produce information/feedback to a provider regarding the number and quality of their records, and provides public health with the information needed to conduct AFIX activities.

Results: The system has been integrated with the Arkansas registry. Data from the duplicate identification process, reporting, CASA, and GIS are captured and is available for each provider in an automated form, via fax-back system or through the Internet using electronic mail. During the presentation the ARFM system components will be reviewed, and the specific reports the system will generate will be discussed.

Conclusion: The ARFM creates a timely information feedback component that all providers can be supplied providing summary data specific to their immunization coverage data. The ARFM can be instrumental in the increase of provider awareness and timeliness of data transmissions, which further illustrates that information they send is being used. Data quality is critical to the success of immunization registries and the ARFM is the missing link with data feedback to the providers.

Learning Objectives: Determine how an electronic feedback module can increase registry data quality and the benefit provided with AFIX activities.

Tired of Hearing About the Same Registry Problems? Learn New Ones to Expect

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Key Words: Registry Managers. Registry Problems. Immunization Registries. Future.

Background: When immunization registries were first created, little information existed regarding the pitfalls and problems managers would encounter. States have invested several years and considerable amounts of money into the development of immunization registries. Now that many areas have registries in various forms of development, new problems are developing. Registries must evolve utilizing current technology and continuous planning is critical. Registry managers need to be informed of new problems so their registries grow and evolve strategically. New ideas and problems need to be researched and solved to prepare for the future using immunization registries as the building blocks for tomorrow's integrated systems.

Objectives: To identify registry issues and future concerns that registry managers need to discuss and solve to assure their registry system evolves as a viable product within future technologic environments.

Methods: The presentation will review the typical problems immunization registries have faced during the past five years. During the past five years these problems have been addressed, researched, and successes documented in regards to registry functionality, confidentiality, data elements, reminder/recall, and HL7 protocols. Now it is time to prepare for the future and begin to identify new and future problems that registry managers will need to address. Based on the presenter's work with several state projects, new ideas will be discussed.

Results: Scientific Technologies Corporation will present lessons learned from working with both statewide and area immunization registries.

Conclusion: Future growth and viability for immunization registries will be dependent on their capability to integrate with other systems. As technology improves, so must registries. Continuous assessment of the physician landscape, and provider feedback for data quality and AFIX activities will be critical to ensure system viability. Future system certification could dictate data use, and registry epidemiology may be tomorrow's headline lead.

Learning Objectives: Learn future registry needs and begin to consider tools and methodologies to make smart registry investments for the future.

Design Issues for Multi-Site/Multi-Platform Immunization Forecasting Software

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Key Words: Computer-based immunization forecasting, ACIP immunization guidelines.

Background: We are developing and maintaining the immunization forecasting program (IMM/Serve) used by the US Indian Health Service's (IHS) Immunization Module (IM). The IHS has 200+ clinics nationwide. While all sites use the ACIP guidelines, each site may fine-tune certain options. IM is implemented in Mumps and runs on three distinct Unix platforms and on Windows NT.

Objectives: To design a single immunization forecasting program for multi-platform operation, whose logic can be customized to local practice preferences. To develop a Web-based environment for testing the logic, including local customizations.

Methods: For platform independence, we implemented IMM/Serve in the ANSI C programming language. For easy changes to the core logic, the knowledge base contains 1) several variations of the forecasting rules, and 2) several tables containing the various parameters (e.g., minimum ages and minimum wait-intervals for doses). IMM/Serve may contain multiple versions of the logic. To facilitate testing, we are building a Web-based environment that lets the user set options, define test cases manually, generate certain types of test cases automatically, run IMM/Serve on those cases, and store the cases and results in a data base.

Results: As of 11/99, IMM/Serve is installed at 12 IHS sites on 4 different platforms. The IHS has currently defined 7 versions of the knowledge for their planned 200+ sites.

Conclusion: A single program can be used to simplify deployment of a multi-site/multi-platform immunization forecasting module. Table driven immunization logic and parameters are essential for multi-site customization.

Learning Objectives: Understand the design, implementation, and support issues for multi-site/multi-platform immunization forecasting software.

101 Issues with Implementing an Immunization Registry Web Interface

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and Mike Garcia, Scientific Technologies Corporation

Key Words: Web Interface. Web enable immunization registry. Browser-based interface.

Background: A Web enabled immunization registry is the new architecture pushed by "technologists" as the answer to a successful registry. But is it really? What are the issues? How can the Internet be integrated to help achieve success? Who are the real users? When does a Web interface become a useful component?

Objective: To describe effective methods for incorporating a browser-based interface into your immunization registry. This presentation will provide issues and recommendations addressing:

- 1) the functionality of the Web Interface,
- 2) how to determine if you need a Web Interface,
- 3) when do you implement this interface?
- 4) resources required, costs and value-added benefits by user category, and
- 5) an implementation plan?

Methods: The newly initiated West Virginia statewide registry is used to illustrate the many issues of Web enabling your immunization registry.

Results: Technical revolution is not the only answer to a successful registry evolution. Web enabled access is important, but planning is the key to success.

Conclusion: A browser-based interface is an essential component of a statewide registry. However, it is not the only component and it is not the full solution for collecting and retrieving data.

Learning Objectives: Discover a process for implementing a successful Web interface to your immunization registry.

Making Lemonade from Lemons: Fresh Strategies Arise from California's Software Evaluation

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Key Words: Evaluation. Regionalization. Software support. Infrastructure. Collaboration.

Background: At least 10 California projects were impacted when HumanSoft went bankrupt in 1998. To resolve this crisis quickly by finding viable software, the California SIIS began to develop evaluation tools and hired outside consultants.

Objective: To describe a positive strategy for registry development that arose out of a rigorous evaluation of a negative software situation.

Methods: Describe software evaluation results. Review response to the evaluation and the choices we made.

Results: Good software products developed by California registries were evaluated and described. Need for web-enabled software was disclosed. Process gave opportunity to standardize best practices. Led to reassessment of statewide strategy in evolution of registries.

Conclusion: We are taking the opportunity to move to a more efficient use of resources by deploying strategies suggested by consultants: replicate selected software product; find 3rd party vendor to support it outside local area; promote regional registries that use good California software products; web enable the software; disseminate standards for best practices.

Learning Objectives: Learn about the environment (organization and infrastructure) that allows State and local projects to collaborate in successfully meeting a crisis situation. Review the reasons for moving from trial-and-error registry development to deployment of best products and practices. Review the types of analytical tools that can be used to make changes.

Development of the ECS ImmuBank Registry and Data Management System

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Key Words: Software. Registries. Data Management.

Background: Immunization registries represent an essential tool for the collection and centralization of immunization records. The integrity of the data collected and the ability to share data among practitioners are key elements in the overall effectiveness of registries. ECS has developed ImmuBank to incorporate the collection, management, and warehousing of immunization data in a unique commercially available software package.

Objective: To describe the ECS ImmuBank and its immunization data management and warehouse capabilities.

Methods: A 2-tier architecture model and an array of 32-bit Microsoft development tools and platforms were used to develop the application. Proprietary algorithms encapsulated in ECS DataSearch and ECS DataMatch Active X components were used to ensure data integrity within a relational database. In addition, user-friendly GUI interfaces were designed to facilitate data administration and reporting.

Results: ImmuBank was shown to successfully collect, warehouse, share, and report both demographic and immunization transaction data for a virtually unlimited number of records. Immunization data were processed through an integrated ACIP schedule to validate vaccinations and to create stored absolute and valid histories. ImmuBank data management components demonstrated flexible administration of the database and the capability to produce accurate reports for overdue vaccinations, patient recall and reminders, and school certificates.

Conclusions: The ECS ImmuBank is a registry software application that uses an integrated methodology for effective collection, warehousing, sharing, and reporting of immunization data.

Learning Objectives: To describe the use of the ECS ImmuBank and its approach to effective data collection and immunization registry functions for improved immunization coverage rates.

Applied Quality Algorithms in the ECS ImmuBank Registry Database

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Key Words: Database. Registry. Data Quality. Deduplication. Data Match.

Background: Typically, demographic data is introduced into registry databases from a wide variety of sources. Data entered into registries are generally not regulated with proper validation algorithms to limit the possibility of duplicate data or clerical errors. Effective use of registries has been hampered by unacceptably high rates of duplicate demographic records. ECS DataSearch and DataMatch software components have been developed to address occurrences of duplicate data in immunization registries.

Objective: To describe the use of ECS software components for data deduplication, matching, merging, and retrieval.

Methods: Unique programmatic algorithms were developed that analyze multiple data fields in each database record for consideration in deduplication, matching, and merging. A weighted value is determined and assigned to selected fields in each record and a ranking ratio is calculated. The interpretation of these ratios by the software forms the basis of the logic to merge records, create new records, or produce a report for administrative scrutiny.

Results: ECS DataSearch and ECS DataMatch components were shown to identify, within acceptable confidence limits, records that required update, records requiring merge, and data that required the creation of a new record during upload and processing of a test data set of immunization records. In addition, records with deemed to have questionable ranking ratios were delineated and reported for administrative review.

Conclusions: The incorporation of ECS DataSearch and ECS DataMatch components into an immunization registry can significantly reduce occurrences of duplicate data and automatically assess records for update and merging.

Learning Objectives: To describe the use of the ECS DataSearch and ECS DataMatch components and their use in immunization registries for effective data deduplication and management.

Effect of Time and Feedback on the Quality of Data Reported via Billing Systems

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Key Words: Data Quality. Electronic Submissions. Billing Systems.

Background: The New York Citywide Immunization Registry (CIR) was established in 1997 and currently contains records for 1.7 million children and over 9 million immunizations. While 19% of providers report electronically, 36% of submissions are electronic, primarily from billing systems.

Objectives: To determine:

- 1) the accuracy and completeness of data reported from billing systems,
- 2) the effect of feedback to providers on data quality,
- 3) the effect of time on data quality,
- 4) the recommended procedures to improve data quality of electronic submissions.

Methods: A random sample of 100 children (aged 0-7) was selected from billing files submitted over a 3-month period in 1997 from each of 11 facilities. Chart reviews and staff interviews were conducted at each facility. Comparisons of billing to chart and CIR to chart data were completed to assess baseline data quality. Feedback was provided to facilities, including UTD status, accuracy and completeness of billing data, identification of errors, and suggestions to improve data quality. A second sample was drawn from 9 of the 11 facilities two years later. (Two facilities changed billing systems.)

Results: On average, the baseline billing submissions were 90% accurate (range: 76-97%) and 89% complete (range: 71-99%). For the 7 of the 9 facilities analyzed to-date, post-intervention billing submissions were 88% accurate (range: 78-99%) and 68% complete (range: 43-97%). Failure to report Comvax was the predominate factor accounting for a decline in completeness.

While feedback improved data quality, new errors occurred, resulting in a net decline in data quality.

Conclusions: The quality of data from billing submissions is generally good. Registries need to closely monitor billing submissions as data quality tends to decay over time without intervention.

Learning Objective: Describe effective ways to improve data quality of billing submissions.

New Techniques for Registry De-duplication in the MEDD De-Duplication Project

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Key Words: Automated De-Duplication. Data Quality. Artificial Intelligence

Background: At the start of this project, the New York Citywide Immunization Registry (CIR) estimated that half of the records in the registry were duplicates. Given the size of the CIR (1.7 million records, and over 8 million immunizations) an automated solution to this problem was vital.

Objectives: Describe the basics of the MEDD de-duplication program, discuss new de-duplication strategies and report the system's current performance

Methods: The CIR has adopted MEDD, a program which uses a new technique from statistical artificial intelligence. This program computes a probability that a pair of records represents the same child based on several dozen different "features" representing matching or non-matching elements on the record pair. Each feature is assigned a weight during a "learning" process by which the system is trained on a set of record pairs tagged by Registry staff. The overall probability for each record pair is based on the number and weight of the features arguing for and against a merge. Record pairs with a high probability are automatically merged. We have recently enhanced this basic system with features which look for minor misspellings and features sensitive to the relative frequency of matching names.

Results: The system has achieved 99.5% accuracy in controlled tests and can reduce clerical workload by over 97.8%. This is twice the accuracy we reported at 1999 immunization conferences.

Conclusions: Careful system tests and experience on live registry data have shown that MEDD is an effective tool for removing duplicate records from immunization registries.

Learning Objectives: Understand the MEDD de-duplication system at a high level, learn some techniques for detecting duplicate records, understand how to measure a system's performance.

Six Steps to Restart Your Registry —Idaho Case Study

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Scientific Technologies Corporation

Key Words: Immunization registry. Replicate. Replan.

Background: Is it possible to develop an immunization registry if past efforts have not been successful? Is it possible to re-energize a state to try again? What does it take to reinvest time and resources to overcome the past history?

Objective: From this experience we have established six steps that can be used to restart a project. This presentation will summarize these six steps as were applied to Idaho. They include

- 1) establish political visibility,
- 2) implement new or renewed leadership,
- 3) locate required funding,
- 4) replan,
- 5) recommit participants and users and
- 6) replicate and best model of other registry successes.

Methods: The state of Idaho, initiated a Needs and Requirements effort in 1994.

Results: The result of this study was a plan that included a six million dollar budget to build a state wide registry. This plan did not receive the necessary support to continue. Local Health Districts began implementing individual information systems to include a registry element. The State Health and Welfare Department initiated a number of immunization programs but the "energy" to create a statewide system soon dissipated when full funding could not be established.

Conclusion: The original six million dollar budget is now 1.6 million dollars. The state has come together to create a new beginning. By 2002, Idaho is expected to have a fully functional statewide immunization registry.

Learning Objectives: In 1999, Idaho refocused their objective to create and implement a registry. A new start.

A Regional Registry's Approach to Quality: Regstat PLUS

Jim Romano, Katie Reed, MPA CNY Immunization Registry

Key Words: Data Quality. De-Duplication. Matching Algorithm

Background: Since 1997, when the first data records began coming into the Central New York population based registry, an effort has been made to provide a systematic approach to maintaining quality assessments of data management. This has become essential as more organizations look to this information, such as managed care. An application was developed that provides the functions necessary to ensure such quality assessments of data. The application designed to assist in database administration is called Regstat Plus.

Objective: To discuss the origin of Regstat Plus, its current uses, and its anticipated future.

Methods: The application is a result of the assessment process associated with the development of an immunization registry. Specific attention is placed on the logic used for the matching algorithm, its limitations, and how they can be overcome, as well as how to manage the de-duplication process of a registry. Finally, once data starts to flow into the system, what checks can be run at the central server to ensure overall data quality?

Results: Initial reviews of the registry data, after one year, showed a duplicate rate of —%. It has been determined that further refinement to the matching algorithm will reduce this rate even further. The application used for manually de-duplicating the database has proven to be efficient enough to allow for a regular cleansing of the database. In addition, scans are run to find potential errors in data. To date participants have responded promptly with their corrections once these errors have been identified.

Conclusions: The quality of the data in a Registry is critical to the success of the database. It is important that an application be in place to facilitate quality assessments by registry staff. In addition as we head into decreases in resources, the more these checks can be automated, the better off the registry.

Learning Objectives: To provide tools to help registries approach data quality management.

The Importance of Quality Data from Clinics in Reducing De-duplication Effort.

Cynthia Rust, Emory University;
David Shields, Arisbe Information Systems, Inc.

Key Words: Technical. Registry. Development. De-duplication. Data Quality

Background: The Emory University De-duplication study investigated 7284 records from 3 registries and improved a de-duplication algorithm (AIRS) to a demonstrated False Positive rate and False Negative rate 0.5% and 1.5% respectively.

Objective: Investigate the degree to which internal duplicates(those generated within clinics) contribute to the effort required in de-duplicating registry data.

Methods: Analyze the Emory De-duplication Study data for proportion of internal duplicates. Investigate the impact of missing data fields on de-duplication of those internal duplicates.

Results: The internal duplicates represented 25.7% of the duplicate pairs we studied, but contributed 35.5% of the pairs requiring human de-duplication. Internal duplicates were present 16.5% of the time when both middle initial and parent/guardian first name were present, and increased to 39.0% when neither field contained data. Furthermore, automatic de-duplication was possible in 89.9% of cases where both client middle name and parent first name were present, but was only possible in 41.1% of cases where neither field contained data.

Conclusions: These are two demonstrated ways in which clinic systems that share data with a registry can reduce the de-duplication problem: eliminate the internal duplicates within their own clinic systems and include middle name and parent/guardian first name in every record.

Learning Objective: Understand how internal duplicates in clinical systems cause problems for de-duplication of Immunization Registry data, and some areas to address at the clinic to help reduce the problem.

Improving the Accuracy and Efficiency of a Registry De-duplication Algorithm

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David Shields, Arisbe Information Systems, Inc.*

Key Words: Technical. Registry. Development.
De-duplication. Accuracy. Efficiency

Background: In order for immunization registries to be successful, duplicate records must be accurately and efficiently dealt with. The AIRS software employed in this study uses pattern matching to de-duplicate registry records in a probabilistic fashion. Pattern matching looks for groups of data elements with known high positive or negative matching probabilities.

Objective: To improve the accuracy, efficiency, and generalizability of the de-duplication algorithm in use by the MATCH Registry in Atlanta.

Methods: 7284 records were studied from three registries with intensive research locating and verifying the duplicates. This verification process produced a gold standard set of known duplicated and known non-duplicated records against which the AIRS algorithm could be improved.

Results: A satisfactory balance between time required by the de-duplication algorithm (less than 1 second per record) and accuracy resulted in a false-positive rate of 0.1% and a false negative rate of 1.5% for the verified data set. Human de-duplication was required for 6.1% of the records studied. The algorithm was successfully applied to 100,000 records from each of the registries studied. False Negatives can be driven to near zero levels, but the time required and the amount of human intervention required goes up. Human intervention can also be reduced to zero, but the number of False Negatives goes up.

Conclusion: De-duplication using pattern matching can be automated to a highly accurate and efficient level.

Learning Objective: Understand techniques to improve accuracy, efficiency, and generalizability, when building de-duplication into Immunization Registry software.

Overcoming the Paper Data Entry Nightmare . . . Making Technology Work For You

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SE Michigan Childhood Immunization Project.*

Key Words: Planning. Technology. Innovation. Feedback.
Data Entry. Quality Assurance.

Background: In Southeastern Michigan there are about 1800 providers administering immunizations. About half of the provider practices use six different paper data forms thus generating an enormous workload, slow entry of data into the registry with as much as a 10-week backlog and many errors occurred because of poor printing.

Objectives: To effectively address a growing data entry backlog; Meet a 72-hour data entry standard; Dramatically reduce the incidence of data entry errors and elevate overall quality assurance standards.

Methods: Review data entry procedures, review scan form technology, redesign a scannable childhood immunization data entry form, engage a data entry organization, conduct a quality assurance assessment, develop a policy and procedures manual and train provider offices.

Results: The 10-week backlog for data entry has been eliminated; records are processed within 72 hours; a universal scan form was developed; errors in data reporting are down to less than .01 percent.

Conclusions: A cumbersome paper data entry process containing multiple shortcomings in data quality can be brought under control through proper planning, good feedback from providers, creative application of existing communication technology, and the continued assurance of timely accurate submission of child immunization data from providers.

Learning Objectives: Provide an innovative method to increase the participation of providers and reduce the quality assurance errors associated with data entry. Share effective planning and provider feedback strategies. Describe the effective application of existing information system technology to help increase the accuracy of immunization data and sustain high quality assurance standards.

Immunization Billing Audit = Quality Data in Registry + Improved Clinic Practice

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Key Words: Audit. Data quality. Missed billing opportunity. Missed revenue. CQI

Background: Immunization registry data in ImmuLink® comes from clinic billing or clinic databases (i.e. electronic medical record). Quality audits of clinic data are conducted prior to each clinic's initial upload into the registry.

Objective: To ensure accurate and complete immunization data in the registry.

Methods: ImmuLink auditors compare information in the patient medical record to the data file submitted to the registry. Vaccine discrepancies are logged and tallied (clinics must meet 90% accuracy and 80% completeness before the data is incorporated into ImmuLink). The auditors also note potential clinical practice issues.

Results: Clinics have become aware of missed billing opportunities and have recouped lost revenue. Children who received inappropriate vaccine were recalled by the clinic and re-immunized. Billing accuracy has improved from < 40% to 90% when all staff work together on immunization issues (vaccine documentation, coding errors or paper flow related to the billing process).

Conclusions: Quality audits of immunization billing files ensure accurate immunization data for the registry. The audit process also provides clinics with information on possible lost revenue and clinical practice issues. Clinics value the audit process not only for knowledge of their immunization billing accuracy and completeness but also because the audit identifies clinical practice issues relating to vaccine administration. Many clinics have incorporated the identified practice into their clinic Continuous Quality Improvement (CQI) programs.

Learning Objectives: Describe how a billing audit process may also assist clinics to improve clinical practice.

Technical Process of De-duplication

David Shields, Arisbe Information Systems, Inc.,
Cynthia Rust, Emory University

Key Words: Technical. Registry. Development. De-duplication

Background: The MATCH Registry in Atlanta, GA began in 1993 to use data from public and private providers. This data came from a wide variety of existing systems, as well as direct data entry. There was no common unique identifier available, so de-duplication has been a major effort. We have found a variety of both glaring and subtle problems. Some of these problems were not the creation of the de-duplication algorithm itself, but of the process by which the software made use of the de-duplication algorithm.

Objectives: To explain the "Technical Process of De-duplication," including the three essential components of

- 1) Search,
- 2) Scoring, and
- 3) Selection,

and how short-comings in any one of them can contribute to reduced effectiveness of probabilistic de-duplication.

Methods: Study and compare results obtained by the use of various techniques and algorithms on three different data sets, whose internal duplicates have been carefully researched.

Results: We solved issues of False Negatives ("missed" matches) by focusing on the Search, reducing this rate to < 1.5%. We solved issues of False Positives ("erroneous" matches) by focusing on the Scoring, reducing this rate to < 0.1%. We solved both kinds of problems created when the number of records for one person is > 2, by focusing on the Selection process.

Conclusions: De-duplication is a problem that can be accurately addressed with "Fuzzy Logic," and can be automated in such a way that it is highly accurate. Proper use of available tools is necessary in order to achieve these results.

Learning Objectives: Understand techniques to improve effectiveness, and pitfalls to avoid, when building de-duplication into Immunization Registry software.

Contribution of Data Elements to De-duplication

David Shields, Arisbe Information Systems, Inc.,
Cynthia Rust, Emory University

Key Words: Technical. Registry. Development.
De-duplication. Data Quality. Data Completeness

Background: The Emory University De-duplication study analyzed data and algorithms from 3 different Registries, including one state Registry, and two regional. This data consisted of a total of 7284 records, which were intensively researched. During the course of this study, we analyzed the contribution of various fields to the capability of the AIRS algorithm (used by the MATCH Registry in Atlanta) to de-duplicate the MATCH data.

Objective: To present the usefulness of various data elements in the client record to the process of probabilistic de-duplication.

Methods: Analyze a subset of the De-duplication Study data, which had values in eleven of the fields used by the de-duplication algorithm. De-duplication Runs were done on this subset, while blanking out individual, and groups, of the various fields we studied.

Results: The AIRS software used by the MATCH Registry is capable of de-duplicating better than 99% of the studied data, with better than 99% accuracy, without human intervention, when all data elements are available. Loss of 5 crucial data elements (out of the 11 data elements analyzed) reduces the capability of fully automatic de-duplication to 6%.

Results: More data elements produces better de-duplication, with dramatically less human intervention required. All fields contribute measurably to the effectiveness of the de-duplication.

Learning Objective: Understand what fields to depend on, when building probabilistic de-duplication into Immunization Registry software.

Data Quality: The Key to a Successful Immunization Registry

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Key Words: Data Quality. Data Entry. Paper Forms

Background: The Citywide Immunization Registry (CIR) was established in 1997 to increase immunization rates and identify New York City's children at risk for childhood vaccine-preventable diseases.

Most providers (79%) report to the CIR on paper — Immunization Registry Reporting Forms (IRRF). Papers are sent to our vendor for data entry and processing. Data is converted to Universal Provider Interface Format (UPIF) file prior to loading into the CIR.

Objectives: To determine the quality of data submitted to the CIR on paper and identify errors made by providers versus errors made by our vendor.

Methods: Six sites were selected to represent different provider types: Two hospital-based pediatric clinics, two community health centers and two pediatrician private practices. Sample sizes varied from 46 to 53 charts per site (n=307). Demographic and immunization data was compared from the medical chart to the IRRF and to UPIF file for each child and reviewed for errors. Three categories of errors were counted: demographic, current immunization and immunization history.

Results: Providers sent 38% of IRRFs with at least one type of error. Eighty percent of demographic errors were due to illegible first or last names in the IRRF. Most of the current immunization and immunization history errors were due to additions (missing in the chart but recorded in the IRRF) and omissions (recorded in the chart but missing in the IRRF). Inaccurate data entry by our vendor resulted in an additional 1.47% of errors in the UPIF.

Conclusions: Encourage effective error elimination through legible writing, accurate data entry and ongoing data quality assessments.

Learning Objective: Describe effective ways to improve data quality of paper forms for a successful Immunization Registry.

The National Immunization Survey Registry Validation Study

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Key Words: Record Matching. Population Coverage.
Response Error. Best Values

Background: It is important to understand the comprehensiveness of registry data as immunization registries mature. The National Immunization Survey (NIS) is available to assist in such an assessment. The NIS is a population-based sample survey of households with young children designed to yield reliable estimates of vaccination coverage for states and selected large metropolitan areas. The number of children from the NIS that can be matched to an area's immunization registry is an indication of how successful the registry is in including all children in its catchment area. In addition, vaccination records from medical providers for NIS sample children can be matched to reports of medical providers made to state registries to assess measurement error. Registry offices from three states will participate in this assessment study.

Objective: To present the study methodology for matching NIS data to immunization data from several states, evaluating registry coverage and assessing measurement errors.

Methods: Assessment of matching algorithms for quality and efficiency; computation of indexes of agreement between the two immunization sources; re-contact with medical providers to determine best values for children whose reports do not agree.

Results: Results from at least the matching phase of the study with NIS immunization records covering the 1995-1998 time period will be presented.

Conclusions: Preliminary conclusions on the study approach and matching phase will be presented.

Learning Objective: Using the richly detailed data that the NIS collects on its children, we can describe and characterize the sources of coverage and measurement error for those children who are more versus less likely to be included in the registry, as well as more versus less likely to have complete immunization data.

Validation of Registry Data

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Key Words: Data Validation. Data Quality. Record Matching.

Background: The Oregon Registry (ALERT) receives data from private providers via a bar-code system and from health plans as electronic transfers from their billing systems. Oregon Health Division has done a separate survey of immunization status for a sample of two-year-old children.

Objective: To compare the data in the registry with the data from the sample to estimate the coverage of the registry and the accuracy and completeness of the registry immunization histories.

Methods: Match the children in the registry to the sample. Compare the immunization records for the matching children.

Results: (Preliminary) 42% of the 2,452 children in the sample were reliably matched. 78% of the sample immunization entries were matched to registry data.

Conclusions: Coverage of the population is poor, indicating that continued recruitment of providers is needed. The registry data is reasonably accurate.

Learning Objectives: Describe how to use existing resources to verify registry data and methods to diagnose data quality problems.

Implementing a Statewide Immunization Registry: Lessons Learned from the Michigan Childhood Immunization Registry's First Two Years

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Key Words: Statewide Immunization Registry. Implementation. Policy. Administration

Background: The Michigan Childhood Immunization Registry (MCIR) is a statewide information system designed to track the immunization status of all of Michigan's children. The registry, operated by the Michigan Department of Community Health is designed to help providers avoid missed immunization opportunities, institute statewide reminders and recalls, provide a solid database for targeted assessment and outreach activities, and most importantly, increase childhood immunization rates.

The first components of the MCIR went online in October 1997. Since that time the MCIR has been implementing new features, loading "legacy" data, and implementing registry use in provider practices. In October 1999 the MCIR finally reached its initial operating capacity and met initial project goals.

Objective: Describe the most important factors and decision points faced in successfully implementing a comprehensive statewide immunization registry.

Methods: Based on the experience of two years of operation this session will review the major policy development, system design, technology selection, implementation, and ongoing support issues as a series of trade-offs.

Results: Policy decisions had major impacts on technology choices and operational issues. Important decision points include whether to load "legacy" data, access methods, and defining user privileges.

Conclusions: Statewide immunization registries are complex and demanding information systems, that are never "complete." Success depends on strong and stable funding, a diverse project team, incremental implementation, intelligent technical decisions, and a careful consideration of data quality issues.

Learning Objective: Understand the policy development, system design, technology selection, and implementation issues that will have the greatest effects on the success of a statewide immunization registry.

Standardization of Decision Rules for Vaccination: An Update On Issues Related to Immunization Algorithms

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Key Words: Immunization schedule. Algorithms. Reminder/Recall. Counting vaccines. Vaccination schedule. Standardization

Background: The Immunization algorithm is a critical component of a fully operational Immunization registry that enables automated decision support and reminder/recall. However, algorithms have been challenging to create due to the ambiguities in the current Advisory Committee on Immunization Practices' (ACIP) Childhood Immunization Schedule.

Objective: To develop a consensus on immunization decision rules.

Methods: The staff from ACIP Workgroup for Standardization of Decision Rules for Vaccination, and staff from National Immunization Program (NIP) have developed the "Standardization of Decision Rules for Vaccination" document. A Technical Workgroup assembled by NIP is also reviewing the issues.

Results: A proposal with a set of operational criteria which would establish clear definitions of optimal and acceptable practices for recommended and minimal age for immunizations and minimum intervals between doses has been developed. The decision rules were arrived at by weighing different and sometimes competing values, most notably safety, efficacy, practicality (e.g., attention to the pediatric visit schedule), expediency (e.g., desire not to miss opportunities to vaccinate), coherence (consistency across antigens), quality assurance, and cost. A chart has been developed showing optimal practice ages and intervals coded in green, suboptimal, but still acceptable practice in yellow, and ages and intervals that would necessitate repeating or not counting a dose in red.

Currently the Workgroup is accepting comments on the proposed decision rules, and testing the rules for utility and practicality in programs using manual and electronic algorithms for scheduling and counting adequacy of immunization histories.

Conclusion: It is expected that, after the public comment period has ended, and a consensus reached, ACIP will finalize the "Standardization of Vaccination Decision Rules," and incorporate the information into an ACIP statement for widespread dissemination and adoption. NIP will continue to provide guidance regarding the implementation of these decision rules for scheduling algorithms by the updating its Programmers' Evaluation Guide and ongoing technical assistance.

Learning Objective: The audience will be able to understand the complexity of and rationale for the "Standardization of Rules for Vaccination," develop the knowledge base to effectively participate in developing the consensus-based immunization decision rules, and help implementation of uniform vaccination algorithms.

Rearchitecting an Immunization Registry for the Web

Alean Kirnak, Manish Kumar: San Diego Immunization Registry

Key Words: Web. Internet. 3-Tier Architecture

Background: The San Diego Immunization Registry made a decision in early 1999 to develop a web interface to its registry. In 1999, much experimenting with technology and strategies was done.

Objectives: To present results of considerable R&D efforts in strategy for porting to a web interface.

Methods: Step 1 was to develop a high level technical plan for carrying out the business objectives through technology. Step 2 was to prototype a web-based system using various technologies and settle on a strategic approach.

Results: An upgrade to a true web interface could not be accomplished by a small change to the existing software, though great efforts were made to find one.

Conclusions: To create a true web-based product, a significant rewrite using new technology platforms and new ways of thinking about the application may be necessary.

Learning Objectives: Audience should benefit from the R&D efforts of San Diego and learn how some web technologies and approaches were tried and discarded, others selected.

Requirements for System Integration: A Multi-Institution Immunization Registry and the World Wide Web

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Key Words: Communication. Internet. User interface.

Background: The Northern Manhattan Immunization Partnership has been deploying an immunization registry across two hospital campuses since April, 1999. Data from diverse sources are aggregated in a central repository. Data may be entered and reviewed through an application using the World Wide Web (WWW) accessed via the Internet.

Objective: The elimination of duplicate data entry was a paramount design requirement. This extended to past immunizations, visit information, demographic data and immunizations administered outside the Partnership. In addition, local specification of the user interface and security authorization was another important goal.

Methods: We created a software module that synchronously receives visit and demographic information from individual hospital and clinic registration systems using the Health Level Seven standard. We collect additional immunization data on registry patients from other sites via an interface to the New York City Citywide Immunization Registry (CIR). We built a WWW application that allows easy entry of basic information of all past immunizations not already captured by the CIR. We created a WWW application that allows individual practice sites to authorize users, update user profiles and revoke authorization. We built an on-line scorecards that allows users at each site to view immunization coverage rates on the clinician, practice and hospital levels of aggregation. We provide site-specific display forms that allow printing of documentation that conforms to medical record standards at each site.

Results: The registry is in use at six practice sites across two hospital campuses. Work proceeds to add an additional hospital campus and affiliated private provider offices during 2000. The registry contains documentation of 242,154 immunizations on 50,482 patients. A total of 465 providers have been authorized to use the registry. Batch entry of previous immunizations, synchronous capture of demographic and visit information and site-specific user authorization and forms all have contributed to user satisfaction. Ongoing changes in the registry application are easily distributed using the WWW.

Conclusion: WWW-based applications have facilitated distributed user control and data collection of a multi-institution immunization registry.

Learning Objectives: Learn the important architectural components of a WWW-based registry architecture that augment user satisfaction.

Maine and New Hampshire's Immunization Information System (ImmPact)

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Key Words: Interstate. Web-based. Innovative. Registry. Collaborative

Background: ImmPact (Maine and New Hampshire's Immunization Information System) is the only multi-state system in the nation that facilitates simple transfer of client records for transient populations. The web-based front end also allows great flexibility and near universal access for providers while still maintaining very strict security and confidentiality safeguards. This system supports a Health Plan generation, a state compliant immunization record, reminder/recall functionality, vaccine inventory management, and an E.P.S.D.T. component.

The ImmPact system is a collaborate effort between the Maine Immunization Program, Maine Medicaid (EPSDT), and New Hampshire Immunization Program. Each program uses the core system of ImmPact, including but not limited to: client file, algorithm engine, and reminder/recall and contact management engine. The cooperative use of these 3 components of ImmPact have led to substantial cost savings in development by each Program and have consolidated client records as well. A single client record can now be accessed and maintained, with proper security permissions, through multiple avenues.

Due to the design of the ImmPact core system, there is the potential to expand this registry system to include other "add-on" components such as WIC, Dental, Lead Interfaces, much like the Medicaid (EPSDT) system uses the core system. This offers the possibility for cost-effective data-management tools based on an existing product.

Objective: To discuss the capabilities, benefits, and acceptance of collaboration efforts for the development and implementation of ImmPact.

Methods: Review development and implementation processes of ImmPact and the roles of the partners.

Results: Current anecdotal feedback indicates overall acceptability in both large and small practices (satisfaction/usability surveys to be distributed in 2000). Preliminary data (reduced instances of service request) show increasing comfort and expertise with the system. Partnerships show enhanced ties and communication.

Conclusion: After 1 year in beta testing with 40 practices in Maine and New Hampshire, the functionality of ImmPact has been well tested and generally well excepted. Feedback was received and evaluated, and we are proceeding with recommended changes to improve usability.

Learning Objectives: Describe the development and subsequent benefits of a Multi-State Web-based Registry in collaboration and in partnership with local, state and federal agencies.